

## REMARKS

### *Status of the Claims*

Claims 1-20 and 22 are pending, with claims 1, 20, and 22 being independent. Claim 21 has been canceled merely to expedite prosecution, without prejudice to or disclaimer of the subject matter contained therein.

Applicants would initially like to thank the Examiner for indicating that claim 20 is allowed. Applicants respectfully request the Examiner to reconsider and withdraw the outstanding rejections in view of the foregoing amendments and the following remarks.

### *Specification*

The disclosure is objected to because the first paragraph did not include the serial numbers that correspond to the applications referred to by their titles. This objection has been obviated by amendment of the paragraph to insert the appropriate application serial numbers. Accordingly, Applicants respectfully request that this objection be withdrawn.

### *Claim Rejection under 35 U.S.C. §§ 102(b)/103(a)*

Claim 21 is rejected under 35 U.S.C. § 102(b) as anticipated by or, in the alternative, under 35 U.S.C. § 103(a) as obvious over U.S. Patent No. 2,620,365 (“Anderson”). Claim 21 has been canceled merely to expedite prosecution, thereby obviating this rejection. Accordingly, Applicants respectfully request that the rejection be withdrawn.

### *Claim Rejections under 35 U.S.C. § 103(a)*

Claims 1-5, 12, 13, 15-19, and 22 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Anderson in view of U.S. Patent No. 4,935,577 (“Huss”). Applicants respectfully disagree with this rejection; therefore, this rejection is traversed.

Anderson relates to an improved two-step process for the conversions of high boiling alpha olefins into lubricating oils characterized by a high viscosity, a high

viscosity index and a low pour point. In the process of Anderson, first a mild isomerization is effected on the high boiling alpha olefins by contacting them with a solid catalyst having alumina as its active component. The mild isomerized product thus obtained is then polymerized with a Friedel-Crafts catalyst. (Column 2, Lines 1-13). Anderson discloses that during this mild isomerization of the alpha olefins, the ***double bond is shifted from the alpha position toward the center of the molecule.*** (Column 1, Lines 37-48).

As recited in independent claim 1, the process of the presently claimed invention comprises inducing ***skeletal isomerization*** of an olefinic feedstock, with boiling points greater than 180°F, producing a skeletally isomerized olefinic feedstock. The skeletally isomerized olefinic feedstock is contacted with an oligomerization catalyst in a catalytic distillation unit having, within it, at least one catalytic zone to produce a product with a higher number average molecular weight than the olefinic feedstock. The product is separated in the catalytic distillation unit into a light by-product fraction and a heavy product fraction, wherein the heavy product fraction comprises hydrocarbons in the lube base stock range.

As recited in independent claim 22, the process of the presently claimed invention comprises inducing ***skeletal isomerization*** of an olefinic feedstock, with boiling points greater than 258°F, producing a skeletally isomerized olefinic feedstock. The skeletally isomerized olefinic feedstock is contacted with an oligomerization catalyst in a catalytic distillation unit to produce a product with a higher number average molecular weight than the olefinic feedstock. The product is separated in the catalytic distillation unit into a light by-product fraction and a heavy product fraction, wherein the heavy product fraction has an initial boiling point of at least 572°F and comprises hydrocarbons in the lube base stock range.

Skeletal isomerization of the olefinic feedstock assists in providing products with pour points in the desired range. Skeletal isomerization of the olefinic feedstock prior to oligomerization results in a higher yield of the lube base oil with a lower pour point (Page 14, 3<sup>rd</sup> and 4<sup>th</sup> Paragraphs). Applicants respectfully submit that one of ordinary skill in the art readily understands that skeletal isomerization and isomerization of alpha olefins such that the double bond shifts from the alpha position

toward the center of the molecule, i.e., double bond isomerization, are significantly different processes.

As readily understood by one of ordinary skill in the art, *skeletal isomerization* refers to a reorientation of the molecular structure of an olefin by formation and elimination of side chains, in particular, formation and elimination of methyl group side chains. In contrast, also as readily understood by one of ordinary skill in the art, *double bond isomerization* refers to relocation of the double bond between carbon atoms while maintaining the backbone of the carbon structure. See, for example, U.S. Patent No. 4,410,753 (disclosing at Column 1, Lines 14-20 that “skeletal isomerization” ... refers to a rearrangement of the carbon structure of an olefinic hydrocarbon and is to be *distinguished from* double bond or geometric isomerization, which involves a shift of a hydrogen atom from one carbon to another in an olefin chain,” emphasis added.) See also U.S. Patent No. 5,182,247 (disclosing at Column 1, Lines 15-22 that, “[i]somerization processes can be directed towards *either* skeletal isomerization or double bond isomerization. Skeletal isomerization is concerned with reorientation of the molecular structure in respect to the formation or elimination of side chains. Double bond isomerization is concerned with relocation of the double bond between carbon atoms while maintaining the backbone of the carbon structure,” emphasis added.) Accordingly, skeletal isomerization and double bond isomerization are two distinct and significantly different processes.

Anderson discloses a mild isomerization of the alpha olefins in which the double bond is shifted from the alpha position toward the center of the molecule. Accordingly, Anderson discloses a double bond isomerization. In contrast, the presently claimed processeses comprise inducing skeletal isomerization of an olefinic feedstock. As Anderson discloses a double bond isomerization of alpha olefins, it is respectfully submitted that Anderson does not disclose or suggest inducing skeletal isomerization of an olefinic feedstock.

Huss relates to oligomerization utilizing catalytic distillation techniques. In particular the process of Huss is directed to an alpha-olefin which is oligomerized in the presence of a catalyst comprising boron trifluoride, a minute amount of water in a particular adsorbent material such as silica to a product predominating in those oligomer fractions having viscosities within the lubricating oil range such as the

trimer and tetramer of 1-decene. (Column 8, lines 36-42). Huss teaches that 1-olefins having from 3 to 20 carbon atoms and preferably 8 to 12 carbon atoms or various combinations of these alpha-olefins can be used. (Column 8, lines 49-51). Huss teaches that in particular trimers and tetramers having viscosities in the lubricating oil range are formed.

It is respectfully submitted that Huss does not disclose or suggest skeletal isomerization of the olefinic feedstock prior to oligomerization. In addition, as Huss teaches oligomerizing 1-olefins having from 3 to 20 carbon atoms, Applicants respectfully submit that making lube base stocks from the olefinic feedstock of Huss requires multiple oligomerization steps. Accordingly, Huss discloses oligomerizing 1-olefins having from 3 to 20 carbon atoms providing trimers and tetramers having viscosities in the lubricating oil range. Accordingly, Applicants respectfully submit that lube base oil products of Huss may have reduced viscosity indexes due to excessive branching. Therefore, as recited in claim 1, Applicants respectfully submit that Huss does not disclose or suggest the presently claimed primarily single oligomerization of a feedstock with a boiling point of greater than 180°F. In addition, as recited in claim 22, Applicants respectfully submit that Huss does not disclose or suggest the presently claimed primarily single oligomerization of a feedstock with a boiling point of greater than 258°F.

To establish a *prima facie* case of obviousness, three basic criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to combine the reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations. MPEP § 2143.

It is respectfully submitted that even if there were some suggestion or motivation to combine the reference teachings and a reasonable expectation of success, the prior art references when combined do not teach or suggest all the claim limitations. Even if combined, Anderson and Huss do not disclose or suggest inducing *skeletal isomerization* of an olefinic feedstock, producing a *skeletally isomerized* olefinic feedstock. Further, even if combined, Anderson and Huss do not disclose or suggest contacting a *skeletally isomerized* olefinic feedstock with an

oligomerization catalyst in a catalytic distillation unit having, within it, at least one catalytic zone to produce a product with a higher number average molecular weight than the olefinic feedstock. Moreover, even if combined Anderson and Huss do not disclose or suggest separating the product in the catalytic distillation unit into a light by-product and a heavy product fraction. Accordingly, even if Anderson and Huss are combined, the resulting combination does not produce all of the claim limitations.

Claims 6 and 7 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Anderson in view of Huss, and further in view of WO 95/21872 (“Abdul-Sada”). Applicants respectfully disagree with this rejection; therefore, this rejection is traversed.

Abdul-Sada relates to an ionic liquid comprising a ternary melt of (a) a compound of the formula  $R_nMX_{3-n}$  wherein R is alkyl, M is aluminium or gallium, and X is halogen; (b) at least one of a hydrocarbyl substituted imidazolium halide and a hydrocarbyl substituted pyridinium halide; and (c) at least one of a hydrocarbyl substituted quaternary ammonium and a hydrocarbyl substituted phosphonium halide. Abdul-Sada discloses that these ionic liquids can be used as catalysts for the oligomerization or polymerization of olefins and also for the alkylation of paraffins, isoparaffins and aromatics with olefins.

As described above, Anderson discloses a process for converting high boiling alpha olefins into lubricating oils comprising conducting a mild isomerization on the high boiling alpha olefins such that the double bond of the alpha olefins is shifted from the alpha position toward the center of the molecule and polymerizing the mild isomerized product with a Friedel-Crafts catalyst.

Also as described above, Huss discloses oligomerizing 1-olefins having from 3 to 20 carbon atoms to provide oligomer fractions having viscosities within the lubricating oil range such as the trimer and tetramer of 1-decene.

Claims 6 and 7 are dependent upon claim 1 and thus recite further limitations. As explained above, Anderson in view of Huss does not disclose or suggest the present claim 1. Abdul-Sada does not disclose any features that would supplement the above-noted deficiencies in Anderson in view of Huss. Therefore, it is respectfully submitted that even if there were some suggestion or motivation to

combine Anderson, Huss, and Abdul-Sada and a reasonable expectation of successs, the documents when combined do not teach or suggest all of the claim limitations of present claims 6 and 7.

Claims 8-11 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Anderson in view of Huss, and further in view of EP 0673352B1 (“Keskinen”). Applicants respectfully disagree with this rejection; therefore, this rejection is traversed.

Keskinen discloses subjecting C<sub>3</sub> to C<sub>20</sub> olefins contained in a feedstock to an oligomerization reaction in the presence of a catalyst in order to produce a product containing oligomers. Keskinen discloses that different types of catalysts may be used in the same reaction system. Keskinen discloses that the use of different catalysts can be illustrated by a process in which the upper side reactor of a conventional distillation column contains ZSM-5 zeolite and the lower side reactor of the column contains a Ni modified zeolite.

As described above, Anderson discloses a process for converting high boiling alpha olefins into lubricating oils comprising conducting a mild isomerization on the high boiling alpha olefins such that the double bond of the alpha olefins is shifted from the alpha position toward the center of the molecule and polymerizing the mild isomerized product with a Friedel-Crafts catalyst.

Also as described above, Huss discloses oligomerizing 1-olefins having from 3 to 20 carbon atoms to provide oligomer fractions having viscosities within the lubricating oil range such as the trimer and tetramer of 1-decene.

Claims 8 – 11 are dependent upon claim 1 and thus recite further limitations. As explained above, Anderson in view of Huss does not disclose or suggest the present claim 1. Keskinen does not disclose any features that would supplement the above-noted deficiencies in Anderson in view of Huss. Therefore, it is respectfully submitted that even if there were some suggestion or motivation to combine Anderson, Huss, and Keskinen and a reasonable expectation of successs, the documents when combined do not teach or suggest all of the claim limitations of present claims 8 – 11.

Claims 14 is rejected under 35 U.S.C. § 103(a) as being unpatentable over Anderson in view of Huss, and further in view of U.S. Patent No. 6,025,533 (“Vora”). Applicants respectfully disagree with this rejection; therefore, this rejection is traversed.

Vora relates to the production of oligomers from light paraffins and olefins by the dehydrogenation of light paraffins and the oligomerization of light olefins. Vora discloses the production of heavy oligomers by a combination of dehydrogenation and oligomerization using a bed of saturation catalyst in a debutanizer to simplify the saturation and recycle of C<sub>4</sub> hydrocarbons to the dehydrogenation zone.

As described above, Anderson discloses a process for converting high boiling alpha olefins into lubricating oils comprising conducting a mild isomerization on the high boiling alpha olefins such that the double bond of the alpha olefins is shifted from the alpha position toward the center of the molecule and polymerizing the mild isomerized product with a Friedel-Crafts catalyst.

Also as described above, Huss discloses oligomerizing 1-olefins having from 3 to 20 carbon atoms to provide oligomer fractions having viscosities within the lubricating oil range such as the trimer and tetramer of 1-decene.

Claim 14 is dependent upon claim 12, which is dependent upon claim 1, and thus recites further limitations of claim 1. As explained above, Anderson in view of Huss does not disclose or suggest the present claim 1. Vora does not disclose any features that would supplement the above-noted deficiencies in Anderson in view of Huss. Therefore, it is respectfully submitted that even if there were some suggestion or motivation to combine Anderson, Huss, and Vora and a reasonable expectation of successs, the documents when combined do not teach or suggest all of the claim limitations of present claim 14.

For at least the above reasons, the rejections under 35 U.S.C. §103(a) should be withdrawn. Such action is respectfully requested.

### ***Conclusion***

For the reasons noted above, the art of record does not disclose or suggest the inventive concept of the presently claimed invention as defined by the claims.



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In view of the foregoing amendments and remarks, reconsideration of the claims and allowance of the subject application is earnestly solicited. The Examiner is invited to contact the undersigned at the below-listed telephone number, if it is believed that prosecution of this application may be assisted thereby.

Respectfully submitted,

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